

INSTRUMENTOS PARA TESTES ELÉTRICOS Test Tutorial

Equipment Type: Protection Relay

Brand: Schweitzer (SEL)

Model: <u>751A</u>

Function: <u>50 or PIOC- Instantaneous Overcurrent and 51 or</u> <u>PTOC – Time Overcurrent</u>

Tool Used: <u>CE- 6003; CE-6006; CE6707; CE-6710; CE-7012 or</u> <u>CE-7024</u>

Objective: <u>Timed pickup test of the units of Phase (51), timed</u> <u>curve survey, instantaneous pickup test of phase units (50).</u>

Version control:

| Version | Descriptions | Date | Author | Reviewer |
|---------|-----------------|------------|--------|----------|
| 1.0 | Initial Version | 12/08/2021 | M.R.C. | M.P.S |



| Sun | nmary |
|-----|---|
| 1. | Relay connection to CE-6006 |
| 1.1 | Auxiliary Source |
| 1.2 | Current Coils4 |
| 1.3 | Binary Inputs5 |
| 2. | Communication with the SEL 751A relay5 |
| 3. | Parameterization of the SEL 751A relay7 |
| 3.1 | General7 |
| 3.2 | Main |
| 3.3 | Phase Overcurrent |
| 3.4 | Phase TOC9 |
| 3.5 | <i>Slot C</i> 10 |
| 4. | Quick software adjustments |
| 4.1 | Opening the Quick12 |
| 4.2 | Configuring the Settings13 |
| 4.3 | <i>System</i> 14 |
| 5. | Channel Targeting and Hardware Configurations15 |
| 6. | Test structure for the 50/51 function17 |
| 6.1 | Main Screen17 |
| 6.2 | Overcurrent Screen |
| 6.3 | Timed element pick-up test19 |
| 6.4 | Instantaneous Element 1 Pick-up Test |
| 6.5 | Instantaneous Element 2 Pick-up Test |
| 6.6 | Curve Points Test |
| 6.7 | Instantaneous 1 Points Test27 |
| 6.8 | Instantaneous 2 Points Test |
| 7. | Report |
| API | PENDIX A |
| A.1 | Terminal Designations |
| A.2 | Technical Data |
| API | PENDIX B |



Statement of responsibility

The information contained in this tutorial is constantly verified. However, differences in description cannot be completely excluded; in this way, CONPROVE disclaims any responsibility for errors or omissions contained in the information transmitted.

Suggestions for improvement of this material are welcome, just user contacts us via email suporte@conprove.com.br.

The tutorial contains knowledge gained from the resources and technical data at the time was writing. Therefore, CONPROVE reserves the right to make changes to this document without prior notice.

This document is intended as a guide only; the manual of the equipment under tested must always be consulted.



The equipment generates high current and voltage values during its operation. Improper use of the equipment can result in material and physical damage.

Only suitably qualified people must handle the instrument. It should be noted that the user must have satisfactory training in maintenance procedures, a good knowledge of the equipment under tested and also be aware of safety standards and regulations.

Copyright

Copyright © CONPROVE. All rights reserved. The dissemination, total or partial reproduction of its content is not authorized, unless expressly permitted. Violations are punishable by law.



INSTRUMENTOS PARA TESTES ELÉTRICOS Sequence for testing the SEL 751A relay in Quick software

1. Relay connection to CE-6006

Appendix A-1 shows the relay terminal designations.

1.1 Auxiliary Source

Connect the positive (red terminal) of the Vdc Aux. Source to pin A01 on the relay terminal and the negative (black terminal) of the Vdc Aux. Source to pin A02 on the relay terminal.



1.2 Current Coils

To establish the connection of the current coils, connect the I1 and I2, I3 and I4, I5 and I6 current channels to pins Z01, Z03 and Z05 of the relay terminal and connect the common of the current channels to pins Z02, Z04 and Z06 of the relay terminal. Using two channels for each current coil increases the maximum current generation limit to 40 A.







1.3 Binary Inputs

Connect CE-6006 binary inputs to relay binary outputs.

- BI1 to pin 301 and its common to pin 302;
- BI2 to pin 303 and its common to pin 304;
- BI3 to pin 305 and its common to pin 306;
- BI4 to pin 307 and its common to pin 308.

The following figure shows the details of these connections.



2. Communication with the SEL 751A relay

First open the "AcSELerator QuickSet" and connect an Ethernet (or serial) cable from the notebook to the relay. Then double click on the software icon.





Click on the icon highlighted below to parameterize the communication settings.

| AcSELerator® QuickSet - [Getting Started with QuickSet] | | | |
|--|--|---|-------|
| File Edit View Communications Tools Windows Help Language | | | _ & × |
| | | | |
| | | | |
| | Settings | | |
| | and a second sec | New Create new settings Read settings from a connected device Open Copen previously saved settings Device Manager Cyen Device Manager | 1 |
| | | Communication | |
| | 23 | | |
| | | Manage Manage offline settings and databases | |
| | ۲ | Update Install and update Quickset software and drivers | |
| | | | |
| | | | |
| Show this window on startup | والمتح والمحص | | ~ |
| TXD RXD Disconnected 10.0.0.15.23 Terminal = Telnet File trans | Fer = YModern | | |

Figure 5

This relay allows three communication options: via serial cable, Ethernet cable and via modem. In this tutorial we used the communication via Ethernet, in this first case visualized on the front panel of the relay through the path "SET / Show > Port> 1> Port 1 Settings" the adjustment "IPADDR" equivalent to setting "Host IP Address" and the "TPORT" option equivalent to the "Port Number (Telnet)" setting.

| Communication Parameters | |
|------------------------------|------|
| Active Connection Type | |
| Network | |
| Could Network Made | |
| Serial Modem | |
| Connection Name | |
| × | _ |
| Host IP Address | |
| 10.0.0.15 | |
| Port Number(Telnet) | _ |
| Z3 Deat Member/(CTD) | |
| Port Number(FIP) | |
| File Transfer Online | |
| | |
| | |
| ⊙ Telnet ○ S5H | |
| User ID | |
| 10.0.0.32 | |
| Password | |
| | |
| Level One Password | |
| •••• | |
| Level Two Password | |
| •••• | |
| Save to Address Book Default | |
| QK Cancel Apply | Help |
| | |



To read the relay settings click on the icon highlighted below.

| 😵 AcSELerator® QuickSet - [Getting Started with QuickSet] | | | | |
|--|-------------------|--|---|-----|
| File Edit View Communications Tools Windows Help Language | | | _ | 5 × |
| | | | | |
| | | | | |
| -10 SZI 22402 | | | | |
| QUICKSET | | | | |
| | Settings | | | |
| | P | New | | |
| | | Create new settings | | |
| ATA | | Read | | |
| | | Read settings from a connected device | | |
| | | Open previously saved settings | | |
| | | Device Manager | | |
| | 193 | | | - |
| | Setup | | | |
| | | Communication | | |
| | | | | |
| | 3 | Manage | | |
| | | Manage offline settings and databases | | |
| | | Update Install and update Ouickset software and drivers | | |
| | | | | |
| | | | | |
| A CARACTER AND A CARACTER | | | | |
| Show this window on startup | | | | ~ |
| TXD RXD Open: Connected 10.0.0.15 23 Terminal = Telnet File | transfer = YModem | | | |

Figure 7

3. Parameterization of the SEL 751A relay

3.1 General

After reading the relay data click on the "+" sign next to "Global" and then "General". This tab set up the nominal values of phase sequence and frequency.



Figure 8

Rua Visconde de Ouro Preto, 77 - Bairro Custódio Pereira - Uberlândia – MG - CEP 38405-202.
Fone (34) 3218-6800Fone (34) 3218-6800Fax (34) 3218-6810Home Page: www.conprove.com.br-E-mail: conprove@conprove.com.br



3.2 Main

Click on "+" signs next to "Group 1" and "Set 1" and choose the option "Main" In this window set up the values of transformation ratios both CT and VT.

| File Edit View Communications Tools Windows Help Lar | quate | . 81 |
|--|---|----------|
| <u>ര ഒര പ പ പ</u> പ പ പ പ പ പ | | |
| The Edit New Communications Table Windows Helps IS © Bradie © Andig Updat © Bradie © Data © | Barrow Barrow< | !@! |
| Group 2 Group 3 | SINGLEV Single Voltage Input | |
| | N Select: Y, N | |
| art#: 751A51A8A3A72851230 Group 1 : Main | | Relay.rd |

Figure 9

3.3 Phase Overcurrent

Click the "+" sign next to "Overcurrent Elements" then "Phase Overcurrent". The relay allows you to adjust up to four elements with definite time and in these tutorial two elements are used. The pick-up value of element 1 being adjusted to 25.0A with an actuation time of 0.3s and element 2 to 37.5A with an actuation time of 0.0s.

| Global General Event Messenger Setings Group Section Synchronized Phasor Measurement Time and Date Management Settings Breaker Fabre | Phase Overcurrent | |
|---|--|--|
| Event Messenger Settings Group Selection Synchronized Phasor Measurement Time and Date Management Settings Breaker Failure | Element 1 | |
| Arc-Flash Protection Arc-Flash Protection Analog Inputs Analog Outputs Station DE Battey Monitor Input Pedounce Breaker Monitor | Sub12 meanum make Uvercurrer. Inp Polog Gallos Sec.) 25,00 Range = 0,000,00,00FF SDPLD. Maximum Phase Overcurrent. Thip Delay (seconds) 0.30 Range = 0,000 o 5,00 SDP1T. Maximum Phase Overcurrent. Trague Control (SELogic) I | |
| Coal Read Access Control Tem Synchronization Source Grave 1 Source Synchronization Source Source Synchronization Source Source State Source Source Neuroid Decourser Neuroid Decourser Neuroid Decourser | Element 2 50/2P Montum Phase Overcurrent Trip Policy (anpp sec.) 37,50 Range = 0,50 to 100,00, OFF 50/2D Maximum Phase Overcurrent Trip Delay (seconds) 0.00 Range = 0,00 to 5,00 50/2T Maximum Phase Overcurrent Torque Control (SElogic) 1 | |
| B: Time Oversurent Element ● RTD Bit Under/Over Voltage Synchronim Deck. ● Synchronim Deck. ● ● Power Factor ● ● Power Eactor ● ● Power Control ● ● Reckers Control ● ● Denard Heter ● ● Locic1 ● | Element 3 SDSP Moximum Phase Overcurrent Trip Policy (ango sec.) OFF Range = 0,50 to 100,00, OFF SD/SD Maximum Phase Overcurrent Trip Delay (seconds) 0xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx | |
| Graphical Logic 1 Group 2 Group 3 Front Panel Report | Element 4 SOPAP Maximum Phase Overcurrent Trip Polup (amps sec.) OFF Range = 0,50 to 100,00, OFF | |

Figure 10



3.4 Phase TOC

Click the "+" sign next to "*Time Overcurrent Element*" then "*Phase TOC*". This option sets the timed element pickup, the time dial and the curve type. The relay allows different adjustments for each phase. For simplicity the settings of all phases are the same.

| Table 1 | | |
|-----------------------|-----------------------|--|
| Pickup Current | 2.5 | |
| Curve Standard | IEC | |
| Curve Type | C1 = Standard Inverse | |
| Time dial | 0.5 | |

| AcSELerator® QuickSet - [Settings Editor - Sol | recorrente (SEL-751A 011 v5.15.1.2)] | |
|---|--|------------------|
| File Edit View Communications Tools Windows Help La | nouade | - 문× |
| | | |
| | | |
| 🖃 🕘 Global | Dhace TOC | ~ |
| 🕘 General | Fliase FOC | |
| - O Event Messenger | | |
| 🕘 Settings Group Selection | A Phase | |
| Synchronized Phasor Measurement | 51AP Time Overcurrent Trip Pickup (amps sec.) | |
| — Imme and Date Management Settings | 2.50 Range = 0.50 to 16.00. OFF | |
| 🔘 Breaker Failure | | |
| Arc-Flash Protection | 51AC TOC Curve Selection | |
| 😟 🔘 Analog Inputs | Ct Select: 11, 12, 13, 14, 15, C1, C2, C3, C4, C5 | |
| 🖅 🔘 Analog Outputs | | |
| Station DC Battery Monitor | 51ATD TOC Time Dial | |
| 🗈 🔘 Input Debounce | | |
| - 🔘 Breaker Monitor | logo intergence interg | |
| 🕘 Data Reset | 51ARS FM Reset Delay | |
| - O Access Control | Calacti V N | |
| Time Synchronization Source | N Deet. 1, W | |
| 😑 🔘 Group 1 | SLACT Constant Time Adder (seconds) | |
| 😑 🕘 Set 1 | | |
| — 🕘 Main | 0,00 Range = 0,00 0 1,00 | |
| Overcurrent Elements | 51 MMP. Minimum Personne Time (seconds) | |
| Phase Overcurrent | | |
| 🕘 Neutral Overcurrent | 0,00 Range = 0,00 0 1,00 | |
| 🕘 Residual Overcurrent | 510TC Phase Time Overcurrent Torque Control (SELogic) | |
| Negative Sequence Overcurrent | | |
| E Overcurrent Element | | |
| - O Phase TOC | | |
| 🕘 Maximum Phase TOC | B Phase | |
| - 🕘 Negative Sequence TOC | 518P. Time Overcurrent Trin Pickun (amns sec.) | |
| - 🕘 Neutral GND TOC | 2.50 Range = 0.50 to 16.00. OFF | |
| 🖳 🕘 Residual GND TOC | | |
| -O RTD | 51BC TOC Curve Selection | |
| B Under/Over Voltage | | |
| - O Synchronism Check | | |
| — O Power Factor | 51BTD. TOC Time Dial | |
| — O Power Elements | 0.50 Range = 0.05 to 1.00 | |
| Frequency | | |
| Trip and Close Logic | 51BR5 EM Reset Delay | |
| Recloser Control | Solart V N | |
| - O Demand Meter | N Souce () N | |
| E 🕒 Logic 1 | 518CT Constant Time Adder (cerconde) | × |
| Part#: 751A51ABA3A72851230 Group 1 : Phase TOC | | 📑 Tutoriais rdh |
| | | Call Tacondon do |
| TXD KXD Disconnected 10.0.0.15 23 Termin | al = Telnet File transfer = YModem | |

Figure 11





Figure 12

3.5 *Slot C*

By clicking on the "+" sign next to "Logic 1" and then "Slot C" you can assign function trips to each output using "Relay Word Bits". The outputs have been linked as follows:

- OUT301 Trip of element 50-1;
- OUT302 Trip of element 50-2;
- OUT303 "OR" logic between the trip signals of the 51 elements of the three phases;
- OUT304 "OR" logic between the pick-up signals of the 51 elements of the three phases.



| AcSELerator® QuickSet - [Settings Editor - Sobr | ecorrente (SEL-751A 011 v5.15.1.2)] | |
|--|---|-----------------|
| File Edit View Communications Tools Windows Help Lang | uage | <u>_ 라 ×</u> |
| 6 🖓 🖹 💋 🖬 🗐 🖶 📴 🞯 🐼 🕱 | | |
| - O Main - O Vercurrent Elements | Slot C | |
| Phase Overcurrent Neutral Overcurrent Residual Overcurrent Negalive Sequence Overcurrent Phase TOC Phase TOC Negalive Sequence TOC Negalive Sequence TOC Neutral GND TOC Neutral GND TOC | OUT301FS OUT301 Fail-Safe N Select: Y, N OUT301 (SELogic) SOP1T OUT302FS OUT302 Fail-Safe N Select: Y, N | |
| TD TO Order/Dver Voltage Order/Dver Voltage Order Eator Power Eator Power Elements Order Elements | OUT302 (SELogic) SOP2T OUT303F5 OUT303 Fall-Safe N Select: Y, N | |
| Trip and Close Logic Recloser Control Demand Meter Logic 1 O SELogic Enables | OUT303 (SELogic) SLAT OR 519T OR 51CT OUT304F5 OUT304 Fail-Safe N Select: Y, N | |
| SELogic Latch Bits SELogic Variables and Timers SELogic Counters Math Variables Sitc A Sitc A | OUT304 (SELODC) SLAP OR SIBP OR SICP | |
| ● Slot E ● Slot E ● Slot E ● Graphical Logic 1 @ ● Group 2 ■ 0 Group 3 | | |
| | | |
| Part#: 751A51ABA3A72851230 Logic 1 : Slot C | | 📑 Tutoriais.rdb |
| TXD RXD Open: Connected 10.0.0.15 23 Term | ninal = Telnet File transfer = YModem | |

Figure 13

After making all the adjustments, click on the icon highlighted in green in the previous figure to send the modifications to the relay. The next figure shows the options that have been modified. To send the changes click on "OK".

| Select Groups/Classes to Sen | |
|--|--------|
| Global Set 1 Set 2 Set 3 | |
| Logic 2 Logic 3 Front Panel Report Port F Port 1 Port 2 Port 3 Modbus User Map DNP Map 1 Settings | ОК |
| DNP Map 2 Settings | Cancel |

Figure 14

Rua Visconde de Ouro Preto, 77 - Bairro Custódio Pereira - Uberlândia – MG - CEP 38405-202.
Fone (34) 3218-6800Fone (34) 3218-6800Fax (34) 3218-6810Home Page: www.conprove.com.br-E-mail: conprove@conprove.com.br



4. Quick software adjustments

4.1 Opening the Quick

Click on the "Conprove Test Center" icon.



Click on the Quick software icon.



Figure 16

Rua Visconde de Ouro Preto, 77 - Bairro Custódio Pereira - Uberlândia – MG - CEP 38405-202.
Fone (34) 3218-6800Fone (34) 3218-6800Fax (34) 3218-6810Home Page: www.conprove.com.br-E-mail: conprove@conprove.com.br



| A L D | -6006 (0320711) | - 0 X |
|---|---|---|
| Arquivo Home Display Software Option | 15 | ~ ? |
| Connection Consection Consection Consection Consection Connection Faidware Pre-fault Fault Fault V N001 | General General Monopole Sector Sec | tore View out • Hamonics Protection • × |
| ✓ Analog. DC Output | Identit: V Model V | |
| Binary Outputs | | |
| GOOSE Outputs | Location: | |
| Ime and Advancement | Substation: | |
| | Address: | |
| | Responsible: | |
| | Sedor: Registry: V | |
| | Tool Test: | DC Value |
| | | DC Value |
| | Default ▼ 0K Cancel | |
| Error List Protection Status | | |
| Solution ON Line New | Aux. Source 110,00 V Heating: 0% | |
| | Figure 17 | |

4.2 Configuring the Settings

When opening the software the "Settings" screen will open automatically (provided that the option "Open Settings when Start" found in the "Software Options" menu is selected). Otherwise, click directly on the "Settings" icon.



Inside the "Settings" screen, fill in the "General Inform." with details of the tested device, installation location and the person responsible. This makes reporting easier, as this tab will be the first to be shown.



| Seneral | General Inform. System Notes & Obs. | Explanatory Figures | Check List Other | rs Connections | |
|---------|-------------------------------------|----------------------------|-----------------------|---------------------|---------|
| | Test: | | | | |
| | Descr: Phase Overcurrent | | Date: | 13/08/2021 12:11:46 | |
| | Tested device: | | | | |
| | Identif: 23031982 | ~ | Model | 751A | ~ |
| | Type: Feeder Prot | ection ~ | Manufacturer: | Schweitzer | ~ |
| | Location: | | | | |
| | Substation: CONPROV | E | | | ~ |
| | Bay: 1 | ~ |] | | |
| | Address: Visconde d | e Ouro Perto75 - Neighborh | nood Custódio Pereira | 1 | ~ |
| | City: Uberlândia | | ~ | Stat | e: MG 🗸 |
| | Responsible: | | | | |
| | Name: Michel Roc | kembach de Carvalho | | | ~ |
| | Sector: Engineering | · ~ | Registry: | 0001 | ~ |
| | Tool Test: | | | | |
| | CE-6006 | Series Num.: | 03207116302101 | 10011XXX | |
| | | | | | |
| | | | | | |
| ault 🗸 | | | | ОК | Cano |

4.3 System

In the following screen, within the Nominal sub tab, the frequency values, phase sequence, primary and secondary voltages, primary and secondary currents, transformation ratios of VTs and CTs are configured. There are also two sub-tabs *"Impedance"* and *"Source"* whose data are not relevant for this test.



Figure 20

Rua Visconde de Ouro Preto, 77 - Bairro Custódio Pereira - Uberlândia – MG - CEP 38405-202.
Fone (34) 3218-6800Fone (34) 3218-6800Fax (34) 3218-6810Home Page: www.conprove.com.br-E-mail: conprove@conprove.com.br



There are other tabs where the user can enter "Notes & Obs., Explanatory Figures," can create a "Check List" of the procedures for carrying out the test and even create a diagram with all the schematic of the connections between the test set and the test equipment.

5. Channel Targeting and Hardware Configurations

Click on the icon illustrated below.



Figure 21



Then click on the highlighted icon to configure the hardware.

Figure 22



Choose the channel configuration; adjust the auxiliary source and the stopping method of binary inputs. To finish click on "OK".

| tings | | |
|--|--|-------------------------|
| aster Slave | Binary Outputs: Auxiliar S | ource: |
| Model: CE-6006 ∨ Serial №: 03207116302101110011× Analog. Outputs: . | BO1: NO V BO2: NO V BO3: NO V | 250 V 220 V 110 V |
| Default - Voltages: | BO4: NO | 60 V 48 V |
| ○ 3 x 300 V; 150 VA ○ 3 x 600 V; 150 VA ○ 2 x 300 V; 200 VA ○ 1 x 300 V; 400 VA | Currents Analog Input: Clamp Scale IA: 100mV/A (10A) ~ IB: 100mV/A (10A) ~ IC: 100mV/A (10A) ~ | 24 V Other Off |
| Not Used Connect VTs Connect VTs | Binary Inputs: Contact 5 Vpk 50 Vpk BI1 & BI2: | . 100 Vr |
| O 3x 20 A; 90 VA → O 3x 20 A; 150 VA ⓐ 3x 40 A; 150 VA O 2x 60 A; 200 VA | BI3 & BI4: | 1 |
| ○ 1 x 120 A; 400 VA Electromechanical: ○ 2 x 20 A; 400 VA ○ 1 x 30 A; 600 VA ○ 1 x 24 A; 1100 VA | 15-6p 13-4p 11-2p | |
| Not Used Connect CTs | DC Mode | |
| TIP: To a void performance protection, connect the current channels before confirming th | e setting. <u>O</u> K <u>C</u> a | ncel |

Figure 23

On the next screen choose "Basic" and on the next window (didn't shown) choose "YES", finally click on "Confirm".

| Cha | nnels Direct. | | | - | | × |
|---------|---|----------------|------------------------|----------|---------|---|
| s Local | Model Reset for Hard. CE-6006 ~ | Set O Advanced | 32000 o ⁹ 8 | | Confirm | |
| emote: | Serial Number: 03207116302101110011XXX | V V ON Line | 50 S. Value | | Cancer | |
| ά. | | | | Import E | xport | |

Figure 24



6. Test structure for the 50/51 function

6.1 Main Screen

First, click on the tab "Protection > Current x time > Overcurrent" so that the data adjusted in the relay are configured in the software. Next, near to the current "I" choose a node as a reference, in this case " AO_I01 ". Only after choosing the node the fields for adjusting the 50/51 functions become active.

| Image: Image: Im | 1) | – a × |
|---|---|---|
| Gones est Channels Concetion Hardware Channels Concetion | On Editing Delete Test Start Story Settings H | Waveform ILL Harmonics Est lspc Offset Accumulation Evaluations Set Vspc Offset Phasors Options Report Options Report Intil support |
| Pre-fault Fault | Monitoring - X | Inputs Bin, GOOSE and Analog Waveform V Accumulations Phasors V Harmonics Protection |
| Fault | Angle Ref.: Auto | Current x time Voltage x time Differential Harm. Restr. Directional Frequency |
| × NO01 | × N001 | Overcurrent Undercurrent |
| Analog DC Output | | An V I: 40 I01 V Multipick-up of timed curve 2.00 Max : 20.00 Chaet V |
| Binary Outputs | | |
| ✓ GOOSE Outputs | | ∞ t[s] |
| Time and Advancement | | 20 |
| | | 10 |
| | | |
| | Timer | 5.0 |
| | Chronometer 1: | 20 |
| | Stop Interf. On Wait | 2.0 Milt Pkn |
| | Disable V 0 s | 1.0 2.0 5.0 10 20 50 |
| | Chronometer 2: | Cantura Time hu: Chron 01 Chron 02 Simulation: |
| | Stop Interf. | Dial Time: |
| | Disable 🗸 | |
| | | The Frenched De Frenched A Frenched Labor Tells 100.00 m |
| | Actuation Look Walt betw. Timers. 0 s | |
| | Fix Max. Generation Time: : : | Inst. 1: Pd Pd t % Tol.: 5,00 % |
| | Man, Increase Ampl. Angle Clean | Inst. 2: Pd Pd t Absol. Tol.: 30.00 ms |
| | ✓ ✓ ↓ 0,500 | |
| Error List Protection Status | | |
| Son Line New | Aux. Source 110,00 | V Heating: 0% |
| | Fi | gure 25 |

6.2 Overcurrent Screen

For the time overcurrent function, the following values are set:

| Table 2 | |
|----------------------|--------|
| Dial Time | 0,5 |
| Timed Curve | IEC NI |
| Timed (Pkp Expected) | 2,5 |





Figure 26

The next adjustment is to enter instantaneous values 1 and 2.

| | Table 3 | |
|---------|------------------|-------------------|
| | Pkp Expected (A) | T Expected |
| Inst.1 | 25,0 | 300ms |
| Inst. 2 | 37,5 | 0ms |





Figure 27

In the "Simulation" field, the fault type, in this case ABC (three-phase) is adjusted, in addition to adjusting the current and time tolerances both relative and absolute. The data shown below are taken from Appendix A.

| Simulation: | ABC 🗸 🗸 |
|-----------------------------|---------------------|
| I % Tol.: I Absol. Tol.: | 5.00 % 100.00 mA |
| t % Tol.: t Absol. Tol.: | 4.00 % |
| Figu | ire 28 |

6.3 Timed element pick-up test

For the pick-up test, a ramp is used to increase the current value. For this, choose the tab "N01" the option "Ramp" and click on the highlighted icon.



| Auguro Hone Display Software Options Process Settings Image: Settings < | ~ |
|---|-----|
| Image: Spine Set: %, SV Set: %, SV Set: %, SV Set: Test: Test: %) Delete Test: Test: %) Delete All Start: Stop Setting: %) Waveform Marmonics Set Set Set: %) Set Set: %, SV Set: %, Set Set: %, Set Set: %) Set Set: %) Set Set: %) Set Set: %) Set: %) Set: %, Set: %) Se | ~ ? |
| Immune Regin Control Regin Regin Control Regin Regin Control Regin Regin <td></td> | |
| Full Current x time Description Proceeding Proceedi | = × |
| Pault Adje ref: Ad | • • |
| Original Channels / Definition Ramp NO01 Point Channels / Definitions Image: Channel of the classes Image: Channel o | |
| Stop Interf. On Wat Disable | |
| Oronometer 2: Stop Interf. Sing Interf. Deable Capture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: Chapture Time by: | |
| Error List Protection Status | |
| T UN LINE IVEW AUX. SOURCE 110,00 V Heating: 0% | |

Figure 29

For the first channel set the value of 2,40A, then right click and choose the following options to configure the currents as balanced three-phase with positive rotation.



Figure 30

Rua Visconde de Ouro Preto, 77 - Bairro Custódio Pereira - Uberlândia - MG - CEP 38405-202. Fone (34) 3218-6800 Fax (34) 3218-6810 Home Page: www.conprove.com.br E-mail: conprove@conprove.com.br -



Select channel "Ia" and adjust the following threshold and increment values.



Figure 31

The next step is to choose the stop interface which in this case is BI04. Start the generation by clicking on the icon below or using the shortcut "Alt + G".



| 👶 🗋 💕 🛃 🥃 Manual 2.02.152 (64 Bits) - CE-6006 (0320711 |) | | – ø × |
|---|---|---|---------------------------|
| Arquivo Home Display Software Options | | | ~ 🕐 |
| Hrd Set. GOOSE Set Sync. Set. Syn | hete Test stete All tete All | Harmonics IL Set Ispc Offset valuations IL Set Vspc Offset Report IB reserved Report IB reserved Performed | |
| Hardware Resi | Its Generation Opti | ons Report Units Layout | |
| Pre-fault + Fault + X | Monitoring • X Inputs Bin., (| SUCSE and Analog Y Waveform Y Accumulations Y Phasors Y Harmoni | cs Protection = X |
| Fault | Angle Ref.: Auto | Voltage x time Differential Harm. Hestr. Directional Frequency | |
| ↑ Channels/ Definition Ramp ∨ | ✓ N001 Overcurrent | Undercurrent | |
| Point Channel Definitions | An 🗸 I | AO_I01 V Mult. pick-up of timed curve, 2,00 Max.: 20,00 |) Chart V |
| la AO_I01 Modules | ÍŬ IJERT | | |
| Ib AO_102 tincr 1,00 s | 2.0 | | |
| | 0.50 | | |
| | 0,10 | | |
| | 0.020 | | |
| 00 | Timers • × 0,0050 | | |
| 2 | 0.0010 Chronometer 1: 0.00050 | | |
| | Stop Interf. On Wait 0,00020 | | Mult Pkoil |
| | BI04 v 0 s).000050 | 1.0 2.0 5.0 10 | 20 50 |
| | Chronometer 2: | Canture Time by: Chron 01 Chron 02 | Simulation: ABC V |
| | Stop Interf. | | Sinulaion. Abc • |
| | Disable V | U.SU Clear | |
| | | IEC Nomai Inv. | I % Tol.: 5,00 % |
| | Actuation Lock Wait betw. Timers: 0 s | Pkp Expected Drp Expected t Expected | I Absol. Tol.: 100,00 mA |
| Binary Outputs | Fix Max. Generation Time: | | 4 % T-1 - 4 00 % |
| | Inst. I | 27.50 A O A O A 0.00 a | t Abaol Tol : 50.00 mo |
| V Time and Advancement | Man. Increase Ampl. Angle Ciccur Inst. 2. | 137,30 A 7 62 1 1 1 63 10,00 8 | 1 Ausor. 101 30,00 ms |
| Error List Destaction Status | | | |
| A ON Line New | Aux Source 110.00 V Heating: | 0% | |
| | Fileses 22 | | |

Figure 32

To view the values being generated click on "N01" within the "Monitoring" tab. After the performance click on the highlighted icon to capture the tested point.



In this case, the pickup found was 2.51A, within tolerance.



6.4 Instantaneous Element 1 Pick-up Test

Click on the "..." icon and enter an initial value of 24,50A, limit value of 25,50A and the increment as 100.0mA.

| Ramp |) | | | | | | | | | | | | × |
|--------|---------------|---------|----------|-----------|--------------|------------|---------|----------|----------------|--------------|------------|--------|---|
| Ram | p Type | | | Direct | | | | Res | et Timers to E | ach increme | enting | | Generation Approx. Time of Each Incr.: 1s |
| Mor | lules | | \sim | | | | | Kee | n Harmonic D | urina Incren | enting | | |
| 1.104 | 100 | | | U I diacu | | | | | p Hamonio D | | lonary | | |
| Initia | l Values | | | | Lim | its and In | creases | | | | | Re | eset |
| Cha | annels/ Defin | ition | | | | | Limit | Incr. | d/dt | N Steps | Time | | |
| Po | int Channel | Mod. | Ang. | Freq. | v | la | 25,50 A | 100,0 mA | 100,0 mA/s | 11,00 | 11,00 s | | |
| la | AO_101 | 24,50 A | 0° | 60,00 Hz | \checkmark | lb | 25,50 A | 100,0 mA | 100,0 mA/s | 11,00 | 11,00 s | | |
| lb | AO_102 | 24,50 A | -120,0 ° | 60,00 Hz | 1 | lc | 25,50 A | 100,0 mA | 100,0 mA/s | 11,00 | 11,00 s | | |
| lc | AO_103 | 24,50 A | 120,0 ° | 60,00 Hz | | | | | | | | | |
| | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Bina | n/ Outpute | | | | | | oute | | | | Attention | The Re | eset Chron settings. Each the Incr., Direct or Pulsed and |
| | Channel | Incr | | | | Chann | el Inc | т | | | | | Incr times, and Reset will be the same for all nodes. |
| | BO01 | | | | | | | | | | | | |
| | BO02 | | | | | | | | | | | | Incr. |
| | BO03 | | | | | | | | | | | - | Limit |
| | BO04 | | | | | | | | | | Initial va | alue | |
| | BO05 | | | | | | | | | | | Ŧ | |
| | BO06 | | | | | | | | | | | G | eneration |
| | | | | | | | | | | | | Tìr | me Every |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | OK <u>C</u> ancel |
| | | | | | | | | | | | | | |

Figure 34

The next step is to choose the stop interface which in this case is "*BI01*". Start the generation by clicking on the icon below or through the shortcut "Alt + G".



| 🕨 🗋 🚔 🚽 Manual 2.02.152 (64 Bits) - CE- | -6006 (0320711) | – 🛛 🗡 |
|--|--|-------------------------|
| Arquivo Home Display Software Option | 15 | ~ ? |
| Birec Hrd Set. So GOOSE Set Direc Sync. Set. ≈, SV Set Channels Connection Add | Image: Construction of the state of the | |
| Hardware | Results Generation Options Report Units Layout | |
| Pre-fault Fault | K Monitoring Annu Series Annu | tection = X |
| Fault | Angle Ref: Auto | |
| Channels/ Definition Ramp Point Channel Definitions ia A0_101 Modules ib A0_102 iher 1.00 s ic A0_03 ifer 1.00 s | Overcurrer Undercurrer Image: Solution in the solu | Chert V Mult Shirth |
| | Stop Interf. Data Time: 0.50 Converting of the first of t | |
| Analog, DC Output | Actuation Lock Wait betw. Timers: 0 s | Absol Tol : 100.00 mA |
| Binary Outputs | Timed: 2,50 A P d | , |
| GOOSE Outputs | [hh:mm:ss] (Approximate) Inst. 1: 25.00 A P a 300.00 ms | t % Tol.: 4.00 % |
| Time and Advancement | Man. Increase Angle Clean Inst. 2 37.50 A P Image 0.00 s | t Absol. Tol.: 50,00 ms |
| Error List Protection Status | | |
| ON Line New | Aux. Source 110,00 V Heating: 0% | |
| | Figure 35 | |

The value of the pick-up was found to be 25,1A being within the range of values provided by the manufacturer.



6.5 Instantaneous Element 2 Pick-up Test

Insert a ramp with an initial value of 37.00A, limit value of 38.00A with an increment value of 100.0mA and use Binary Input 2 (BI02) as the stop interface. After the



performance capture the point by clicking on the highlighted icon. The figure below shows the point already captured.



The value of the pick-up was found to be 37,4A being within the range of values provided by the manufacturer.

6.6 Curve Points Test

In this case, multiples of the timed element pickup is chosen as current values to be tested. The first point tested was multiple 2 located at the beginning of the curve. As the pickup is 2,5A the current value of the first point to be tested is 5,0A. In this case, you must remove the ramp and choose the direct option. Change input binary to *"BI03"* wait for actuation and capture point by clicking highlighted icon.





Figure 38

Repeat the process and choose other multiples, for example 3 and 5. The user can to test as many points as he deems necessary. However the 3 points are enough to prove the time dial, the norm and the curve type.



The time found for each point is within the tolerance provided by the manufacturer.



6.7 Instantaneous 1 Points Test

To check the operating time of element 1, choose BI01 and test points with current values above the pick-up value. The following figure shows the 26,0A value already captured and the 36,0A value not yet captured.

| Image: Image | | - 0 × |
|--|--|--|
| Image: Spin Content of the set. Image: Spin Content of the set. Image: Spin Content of the set. Direc Image: Spin Content of the set. Image: Spin Content of the set. Direc Image: Spin Content of the set. Image: Spin Content of the set. Direc Image: Spin Content of the set. Image: Spin Content of the set. Direc Image: Spin Content of the set. Image: Spin Content of the set. Hardware Hardware Image: Spin Content of the set. | In Editing In Editing It is tart Stop It is Generation It is Generat | - |
| Pre-fault + X | Monitoring | Protection = × |
| Fault | Angle Ref.: Auto | |
| ▲ Channels/ Definition Direct ✓ | Channels/ Definition Overcurrent Undercurrent | |
| Point Channel Mod. Ang. Freq. ia AD_0101 36.00 A 0* 60.00 Hz ib AD_02 36.00 A 120.0* 60.00 Hz io AD_03 36.00 A 120.0* 60.00 Hz | Times × x Sop interf. Operated 101 BI01 324.9 ms | Chat V Mut. Rkpt1 20 50 |
| Analog. DC Output Binary Outputs GODSE Outputs Time and Advancement | Otronometer 2: Capture Time by: Capture Time by: Capture Time by: Chron. 01 Chron. 02 Diable Diable Actuation Look Viait betw. Timers: Find Kax: Generation Time: Find Kax: Find Kax: | Simulation: ABC 1 % Tol:: 5.00 % I Absol. Tol:: 100.00 mA t % Tol:: 4.00 % t Absol. Tol:: 50.00 ms |
| | ✓ ✓ ↓ 0,500 | |
| Error List Protection Status | Aux Source 110.00 V Hasting 04 | |
| -7 ON LINE IVEW | Figure 40 | |

It is verified that the operating times are within the tolerance.

6.8 Instantaneous 2 Points Test

To check the operating time of element 2, choose BI02 and test points with current values above the pick-up value. The following figure shows the 38,0A value already captured and the 40,0A value not yet captured.





Figure 41

It is verified that the operating times are within the tolerance. By choosing the option *"Table"* and in the tab *"Ixt"* you will find the current and time values captured, the allowed time range and the final approval of the tested points.

| Arc | uivo Home | – Manual 2 Display | .02.152 (64 B Softwar | its) - CE-6006 ((e Options |)320711) | | | | | | | | | | | | | | | | - | > × ^ ? |
|--|-----------------|-------------------------|--------------------------|--------------------------------|----------|-------------------------------|--|-------------|--------------|--------------------|--------------------------|-----------------------|--------------|--------------------------------|---------------------------|------------------|---|----------------------------|------------|------------|----------|------------|
| E Ch | Direc annels | Set. 60 C | 500SE Set 5V Set | Add Reedit Test Test | Del Del | on Edit lete Te lete Al | ting est | • st | art Stop | Setting | ₩ ■ * 1 | Waveform Accumulation | La, Harmonic | s II Set Isp ns IIV Set Vsp | c Offset c Offset F | resent teport | → III III III III III III III I | reate Restor arts Layou | e View | | | |
| | Dra-fault / E | ardware | | | - Y | | Monitor | ing | eneration | 1 | - ~ | Inpute Rie | ptions | d Analog | Wayefor | | nits | Dharorr | Harmonics | Protection | | = ~ |
| É | Eault | | |] | • ^ | | Angle | Ref: Auto | | | | Current x tim | e Voltage | x time Dif | ferential H | lam Bestr | Direction | al Frequer | | Trotection | • | • ~ |
| | 1 duit | _ | | 1 | | | Angle I | Note: Auto | | | | Overcurren | t Undercu | rrent | | | | | , | | | |
| 1^ | Channels/ I | Definition | Direct | ~ | | 1^ | Chanr | nels/Defini | tion | | | | | | | | | | | | | |
| | Point Cha | nnel Mod | Ang. | Freq. | | | Point | Channel | Mod. | Ang. | -11 | An ~ | 1: AO_10 | ~ | Mult. pi | ck-up of time | d curve, [2, | 00 Ma | C: [20,00 | | Table | ~ |
| | | 01 40,00 | 0 -1200 | 60,00 Hz | | | la Ib | AO_101 | 40,00 A | 240.0* | -11 | bxt P | kp / Drp | | | | | | | | | |
| | Ic AO | 03 40.00 | DA 120.0 ° | 60.00 Hz | | | lc | AO 103 | 40.00 A | 120.0 ° | -11- | Point | I Capt. | Theoretic | t Min. Exp. | t Max. Exp | t Capt. | Error % | Abs Error. | Status | | |
| | | | | | | | | | | | -1- | 01 | 5,00 A | 5,02 s | 4,50 s | 5,64 s | 5,10 s | -1,65 | -82,83 ms | Passed | | |
| | | | | | | | | | | | | 02 | 12.50 A | 2.14 c | 1 00 c | 2,30 c | 2 15 6 | -0,015 | -20,00 ms | Passed | | |
| | | | | | | | | | | | | 04 | 26.00 A | 300.0 ms | 250.0 ms | 1.55 s | 331.0 ms | -10.32 | -30.96 ms | Passed | | |
| | | | | | | | | | | | × ا | 05 | 36.00 A | 300.0 ms | 100.00 µs | 350.0 ms | 324.9 ms | -8.30 | -24.91 ms | Passed | | |
| Ş | | | | | | 1 | Timers |) | | | • X | 06 | 38,00 A | 100,00 µs | 100,00 µs | 350,0 ms | 24,58 ms | -24480,0 | -24,48 ms | Passed | | |
| 1~ | | | | | | 6 | moomet | or 1: | | | | 07 | 40,00 A | 100,00 µs | 100,00 µs | 50,10 ms | 23,45 ms | -23350,0 | -23,35 ms | Passed | | |
| | | | | | | SI E Ch SI | top Interf BIO2 hronomet top Interf | er 2: | 2 | oerated 3,45 ms | | Dial Ti | me: 0,50 | | Capture Tim | e by: | hron. 01 O | Chron. 02 Clear | | Simula | tion: AB | c ~ |
| | | | | | | | Disable | | × | | | Timed Cu | ve: IEC No | mai Inv. | ``` | 1 | <i>j</i> 4 |) 🖌 🕥 | | 1.97 | T-1. E(| 0.*/ |
| ~ | Analog. DC O | utput | | | | | Actuation | Lock W | ait betw. Ti | mers: 0 s | _ | | Pkp Ex | pected | Dm E | roected | t | Expected | | LAbsol. | Tol.: 10 | 0 % |
| ~ | Binary Output: | 3 | | | | | - | | | | | Tim | ed: 2,50 A | P 💰 | | P | đ | | | | 1.4 | |
| GOOSE Outputs Fix Max. Generation Time: (ht:mm:ss) (Approximate) | | | | | ins | . 1: 25.00 | A P 🖌 | | P | d 3 | 00.00 ms | | t % | Tol.: 4.0 | 0 % | | | | | | | |
| Time and Advancement Man. Increase Ampl. Angle Clean | | | | | Ins | . 2: 37,50 | ► <i>P</i> | | P | đ |),00 s | | t Absol. | Tol.: 50 | 00 ms | | | | | | | |
| | Connaution D | | | | | | | . 1 | | | • | | | | | | | | | | | |
| 49 | ON Line | Ne Ne | ew | | | | | | A | IX. Source 1 | 110,00 | V Heating: | 0% | | | | | | | | | |
| | | | | | | | | | | | Fi | igure 4 | 2 | | | | | | | | | |



By clicking on the "Pkp/Drp" tab, the expected, captured values, relative and absolute errors for the pick-up tests are observed, as well as the final approval of the tested points.

| 🧶 🗋 💣 🚽 = Manual 2.02.152 (64 Bits) - CE-6006 (0320711) | - 0 × |
|---|-------------------------------|
| Arquivo Home Display Software Options | ^ 😯 |
| Image: Second | Restore View Layout • |
| Pre-fault / Fault + X Monitoring + X Insufs Bin, GOOSE and Analog Waveform / Accumulations / Phase | sors Harmonics Protection = x |
| Events | Frequency |
| | ricquerey |
| Channels/ Definition Direct A Channels/ Definition A Overcurrent | |
| Point Channel Mod. Ang. Freq. Point Channel Mod. Ang. I: AO_011 ~ Mult. pick-up of timed curve. 2.00 | Max.: 20,00 Table V |
| la AD_101 40.00 A 0* 60.00 Hz la AD_101 40.00 A 0* bt Pkp / Dpp | |
| Ib AO_102 40,00 A -120.0* 60,00 Hz Ib AO_102 40,00 A 240.0* IExo, I Capt. Error & Abs Error. Status | |
| lc AD_103 40,00 A 120.0* 60.00 Hz lc AD_103 40.00 A 120.0* Time Pkp 2,50 A 2,51 A -0,400 % -10,00 mA Passed | |
| Time Drp | |
| Insti Pkp 25,00 A 25,10 A -0,400 % -100,0 mA Passed | |
| → mint Cip International Cip | |
| ∑ | |
| Chronometer 1: | |
| Stop Interf. Operated | |
| BI02 ~ 23.45 ms | |
| | |
| Chronometer 2: Capture Time by: Chron, 01 Chron, 01 | n. 02 Simulation: ABC V |
| Stop Interf. Dial Time: 0,50 Clear | ar |
| Timed Curve: IEC Normal Inv. | I % Tol.: 5,00 % |
| Analog. DC Output Actuation Lock Wait betw. Timers: 0 s Pkp Expected Drp Expected t Expecte | ted I Absol. Tol.: 100,00 mA |
| V Binary Outputs | |
| ▼ GOOSE Outputs Inst. 1: 25.00 A P 2 300.00 m |) ms t % Tol.: 4,00 % |
| V Time and Advancement Man, Increase 🗸 Ampl. Angle Clean Inst. 2: 37.50 A P 🧹 P 🖉 0.00 s | t Absol. Tol.: 50,00 ms |
| | |
| Error List Protection Status | |
| 4 ON Line New Aux. Source 110.00 V Heating: 0% | |

Figure 43

7. Report

At the end of the test, an automatic report can be requested, just click on the icon illustrated below or use the shortcut "Ctrl + R".



When requesting the report, a screen opens where the user chooses the information that should be shown in the report.



| Presentation Setting | × |
|---|---|
| Language Inglês En-US 🗸 🗸 | |
| All General Data of Test General Data of Tested Device Ge | |
| OK Cancel | |

Figure 45



Figure 46



APPENDIX A

A.1 Terminal Designations

| 01 • IA 02 03 • IB 04 05 • IC | E 0 1 — VA VA E02 — VB (COM E03 — VC VC E04 — N COM WYE OPEN DELTZ E05 — VS E06 — NS E07 — VBAT+ | 01 IN_01 02 IN_01 03 IN_02 04 IN_02 05 IN_03 06 IN_03 07 IN_04 08 IN_05 10 IN_05 11 (| 01 0UT_01 02 0UT_02 03 0UT_02 04 0UT_02 05 0UT_03 06 0UT_03 07 0UT_04 08 0UT_04 09 41+ 10 40_01 11 1 | PORT 1 ETHERNET □ □ 10/100BASE-T PORT 2 FIBER OPTIC TX ③ RX ③ 01 + IRIG-B 02 - - | | U33460121 |
|--|--|--|--|--|--|--|
| 07 • IN 08 | E08 — VBAT- E 500 | 0 IN_06 12 13 13 IN_07 14 IN_07 15 IN_08 16 IN_08 INPUTS: 125V ≂ D 400 | 12 IN_01 13 IN_02 14 IN_02 15 IN_03 16 IN_03 INPUTS: 125V ≂ C 300 | PORT 3 EIA-232 1 +5 Vdc 2 RXD 3 TXD 4 +1RIG-B 5 GND 6 -1RIG-B 7 RTS 8 CTS 9 GND B 200 | 09 IN_01 11 IN_02 12 IN_02 INPUTS: 125V ~~ A 100 | PORT F E1A-232 1 N/C 2 RXD 3 TXD 4 N/C 5 GND 6 N/C 7 RTS 8 CTS 9 GND |

Figure 47



A.2 Technical Data

Instantaneous/Definite-Time Overcurrent (50P, 50G, 50N, 50Q)

Pickup Setting Range, A Secondary

| 5 A Models: | 0.50-100.00 A, 0.01 A steps |
|----------------|------------------------------|
| 1 A Models: | 0.10-20.00 A, 0.01 A steps |
| 50 mA Models: | 5.0-1000.0 mA, 0.1 mA steps |
| 2.5 mA Models: | 0.13-12.50 mA, 0.01 mA steps |
| | |

(The 50N elements in the 2.5 mA and 50 mA models have a built-in 30 ms security qualifier time delay.)

| Accuracy: | ±5% of setting ±0.02 • I _{NOM} A secondary (steady-state pickup) |
|----------------------|--|
| Time Delay: | 0.00–5.00 seconds, 0.01 seconds steps |
| Pickup/Dropout Time: | <1.5 cycles |

Inverse-Time Overcurrent (51P, 51G, 51N, 51Q)

Pickup Setting Range, A Secondary:

| 5 A Models: | 0.50-16.00 A, 0.01 A steps |
|----------------|---|
| 1 A Models: | 0.10-3.20 A, 0.01 A steps |
| 50 mA Models: | 5.0-160.0 mA, 0.1 mA steps |
| 2.5 mA Models: | 0.13-2.00 mA, 0.01 mA steps |
| Accuracy: | ±5% of setting ±0.02 • I _{NOM} A secondary (steady-state pickup) |
| Time Dial: | |
| U.S.: | 0.50-15.00, 0.01 steps |
| IEC: | 0.05-1.00, 0.01 steps |
| Accuracy: | ±1.5 cycles, ±4% between 2 and 30 multiples of pickup (within rated range of current) |



APPENDIX B

Equivalence of software parameters and the relay under test.

| Table 4 | | | | | | | | |
|-------------|--------|---|--------|--|--|--|--|--|
| Quick Soft | ware | SEL 751A Relay | | | | | | |
| | | | | | | | | |
| Parameter | Figure | Parameter | Figure | | | | | |
| Dial Time | 26 | 51_TD TOC Time Dial | 11 | | | | | |
| Timed Curve | 26 | 51_C TOC Curve Selection | 11 | | | | | |
| Timed | 26 | 51_P Time Overcurrent Trip Pickup | 11 | | | | | |
| Inst. 1 | 27 | 50P1P Maximum Phase Overcurrent Trip Pickup | 10 | | | | | |
| t Expected | 27 | 50P1D Maximum Phase Overcurrent Trip Delay | 10 | | | | | |
| Inst. 2 | 27 | 50P2P Maximum Phase Overcurrent Trip Pickup | 10 | | | | | |
| t Expected | 27 | 50P2D Maximum Phase Overcurrent Trip Delay | 10 | | | | | |